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10/029,204	12/28/2001	Kenji Shimizu	Q63141	5380

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EXAMINER	
BERNATZ, KEVIN M	

ART UNIT	PAPER NUMBER
1773	

DATE MAILED: 01/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/029,204	SHIMIZU ET AL.
	Examiner	Art Unit
	Kevin M Bernatz	1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,10,12-17 and 19-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,10,12-17 and 19-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. Amendments to the specification and claims 1 -20, filed on September 4, 2003, have been entered in the above-identified application.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Priority

3. Acknowledgment is made of applicant's claim for domestic priority based on an provisional application filed on February 16, 2001. It is noted, however, that applicant has not filed a certified copy of the Japanese language provisional application as required by 35 U.S.C. 119(e). See MPEP 201.11 (F).

Specification

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title change is suggested: insert "Utilizing a Multilayered Soft Magnetic Underlayer" after "Magnetic Recording Medium".

Claim Rejections - 35 USC § 102

5. Claims 1 – 7, 10, 13, 14, 16, 17, 20 and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Hikosaka et al. (U.S. Patent No. 5,792,564) as evidenced by Fullerton et al. (U.S. Patent No. 6,391,430 B1).

Regarding claims 1, 10, 16 and 20, Hikosaka et al. disclose a magnetic recording medium comprising, in sequence, on a nonmagnetic substrate (*Figure 4, element 11*), at least one soft magnetic underlayer (*element 12*), a non-magnetic layer (i.e. applicants' "orientation control layer" - *element 13*), and a perpendicular magnetic layer (*element 1 and col. 4, lines 16 - 21*), wherein said soft magnetic underlayer has a multilayer structure (*Figure 5*) having a plurality of soft magnetic layers comprising a soft magnetic material (*element 12 and col. 10, lines 25 – 26*), and one or more separation layers (*element 14*) interposed between said soft magnetic layers (*Figure 5*), and at least one of said soft magnetic layers comprises a material with a structure having no magnetic domain walls (*col. 3, lines 43 – 46; col. 10, lines 15 – 20; and col. 22, lines 10 - 20*).

Regarding the limitations "a direction of magnetization of an upper soft magnetic layer is different from a direction of magnetization of a lower soft magnetic layer" and "the direction of the magnetization of said soft magnetic layer is along the radius of said nonmagnetic substrate and is oriented towards the periphery of the substrate or towards the center of said nonmagnetic substrate", it has been held that where claimed and prior art products are identical or substantially identical in structure or composition, or are produced by

identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established and the burden of proof is shifted to applicant to show that prior art products do not necessarily or inherently possess characteristics of claimed products where the rejection is based on inherency under 35 USC 102 or on *prima facie* obviousness under 35 USC 103, jointly or alternatively. Therefore, the *prime facie* case can be rebutted by ***evidence*** showing that the prior art products do not necessarily possess the characteristics of the claimed product. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). "When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the same, the applicant has the burden of showing that they are not." *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

In the instant case, the disclosed structure in Figure 5 comprises alternating layers of antiferromagnetic material and soft ferromagnetic material exchange coupled together by the bias field generated by the antiferromagnetic layers (*col. 10, lines 5 – 37*). Antiferromagnetically coupled layers are known to have directions of magnetization antiparallel to one another, as evidenced by Fullerton et al. (*Figures 2, 4A and 4B and col. 4, lines 54 – 57*) and Hikosaka et al. discloses that the bias field "is applied normal to the recording track of the medium (**i.e. in the radial direction of the medium**)" (*col. 10, lines 15 – 20, emphasis added*).

Therefore, in addition to the above disclosed limitations, the presently claimed properties of "at least one set has different direction ... layers", "at least

one set has ... antiparallel" (*claim 10*), and "the direction of the magnetization ... the center of the nonmagnetic substrate" would have inherently been present because the disclosed ferromagnetic/antiferromagnetic layers are known in the art to produce magnetic directions that are antiparallel and Hikosaka et al. teach that the bias magnetic fields are in the radial direction, and there is no evidence currently of record showing that the disclosed prior art products do not necessarily possess the characteristics of the claimed product.

Regarding the limitation(s) "to control the orientation of the layer immediately above", since all layers effect the grain epitaxy of the layers subsequently deposited (either by grain growth or improved adhesion, etc), the non-magnetic layer (*element 13*) is deemed to inherently meet the above claimed limitation.

The limitation "having an axis of easy magnetization which is oriented mainly perpendicular to the nonmagnetic substrate" is simply the definition of a perpendicular magnetic layer and is therefore met by the disclosed Hikosaka et al. magnetic layers (*see also Figure 10*).

The apparatus element "and a magnetic head for carrying out recording and reproducing of information to and from the magnetic recording medium" is a nominal element for a magnetic recording and reproducing device, and is met by Hikosaka et al. (*Figures 6 - 10*).

Regarding claims 2, 13, 17 and 21, Hikosaka et al. disclose soft magnetic layers meeting applicants' claimed limitations (*col. 9, lines 20 - 25*).

Regarding claims 3 and 4, Hikosaka et al. disclose embodiments meeting applicants' claimed limitations (*Figure 5 wherein element 14 is disclosed to be formed from an "artificial lattice films such as CoFe/Cu films" – col. 11, lines 1 – 10. The Examiner notes that CoFe is a known soft magnetic film*).

Regarding claims 5 - 7, Hikosaka et al. disclose embodiments meeting applicants' claimed limitations (*col. 10, lines 25 – 30 and col. 14, lines 54 – 55; wherein CoFeTa is known to possess a saturation magnetic flux density ($B_s \sim 4\pi M_s$) of greater than 0.4 T, giving a Bs*t value of at least 40 T nm for the disclosed 100 nm layers – see pertinent prior art cited below - Saito*).

Regarding claim 14, Hikosaka et al. disclose structures meeting applicants' claimed limitations (*Figure 5 – element 12 adjacent to element 13*).

6. Claims 1, 3, 4, 8, 10, 14, 16 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Shukh et al. (U.S. Patent Application No. 2002/0028357 A1).

Regarding claims 1, 16 and 20, Shukh et al. disclose a magnetic recording medium comprising, in sequence, on a nonmagnetic substrate (*Figure 2, element 38*), at least one soft magnetic underlayer (*element 40*), a spacer layer (i.e. applicants' "orientation control layer" - *element 42*), and a perpendicular magnetic layer (*element 44 and Paragraph 0002*), wherein said soft magnetic underlayer has a multilayer structure (*Figure 3*) having a plurality of soft magnetic layers comprising a soft magnetic material (*elements 48 and 52 and Paragraphs 0025 - 0029*), and one or more separation layers (*element 50, 54 and 56*) interposed

between said soft magnetic layers (*Figure 5*), and at least one of said soft magnetic layers comprises a material with a structure having no magnetic domain walls (*Paragraphs 0008, 0009 and 0031; wherein Shukh et al. state that the entire soft magnetic layer is a single domain and not plural domains separated by magnetic domain walls: "the soft magnetic underlayer 40 can be maintained in a generally stable single domain state"*).

Regarding the limitations "at least one set has different direction ... layers", "at least one set has ... antiparallel" (*claim 10*), and "the direction of the magnetization ... the center of the nonmagnetic substrate", Shukh et al. disclose antiparallel magnetic directions in the soft magnetic underlayer(*Figures 2 and 3 and Paragraphs 0029 and 0037*). While Shukh et al. does not explicitly teach that the directions shown in Figure 3 are in the radial direction, the Examiner notes that the disclosed Shukh et al. invention is substantially identical to applicants' claimed invention. Specifically, Shukh et al. disclose a perpendicular recording medium using a multilayered soft magnetic underlayer which has antiparallel magnetic directions and no domain walls. As such, the Examiner deems that there is sound basis for the belief that the above limitations would be inherently met by the Shukh et al. invention given the disclosed magnetic directions in Figures 2 and 3. Specifically, the Examiner has taken the position that the magnetization directions shown in Figure 3 are in the radial direction based on the substantially identical structure between the Shukh et al. invention and applicants' disclosed invention.

Regarding the limitation(s) "to control the orientation of the layer immediately above", since all layers effect the grain epitaxy of the layers subsequently deposited (either by grain growth or improved adhesion, etc), the spacer layer (*element 42*) is deemed to inherently meet the above claimed limitation.

The limitation "having an axis of easy magnetization which is oriented mainly perpendicular to the nonmagnetic substrate" is simply the definition of a perpendicular magnetic layer and is therefore met by the disclosed Shukh et al. magnetic layers.

The apparatus element "and a magnetic head for carrying out recording and reproducing of information to and from the magnetic recording medium" is a nominal element for a magnetic recording and reproducing device, as disclosed by Shukh et al. (*Figures 1 and 2*).

Regarding claims 3, 4 and 8, Shukh et al. disclose embodiments meeting applicants' claimed limitations (*Figure 3 elements 50, 54 and 56 and Paragraphs 0027 and 0028*).

Regarding claim 14, Shukh et al. disclose structures meeting applicants' claimed limitations (*Figure 3 – element 52*).

Claim Rejections - 35 USC § 103

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hikosaka et al. as applied above, and further in view of Shukh et al. ('357 A).

Hikosaka et al. is relied upon as described above.

Hikosaka et al. fail to disclose the thickness of the Cu layers used in the CoFe/Cu lattice structures.

However, Shukh et al. teach that the exact thickness of the Cu layer used in a CoFe/Cu superlattice is considered a cause-effective variable based on the desired exchange coupling relationship, and further teaches thickness values meeting applicants' claimed limitations (*Paragraphs 0028 and 0030*).

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as the Cu lattice layer thickness through routine experimentation. *In re Boesch*, 205 USPQ 215 (CCPA 1980), *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

8. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hikosaka et al. as applied above, and further in view of Akiyama et al. (U.S. Patent No. 5,815,342).

Hikosaka et al. is relied upon as described above.

Hikosaka et al. fail to disclose a hard magnetic layer formed between the nonmagnetic substrate and the soft magnetic underlayer, wherein the magnetization of the hard magnetic layer is directed along the radius of the substrate and towards the periphery or the center of the substrate, and bonded with the magnetization of the soft magnetic layer which is the lowest layer of the soft magnetic underlayer.

However, Akiyama et al. teach that one can add a hard bias magnetic layer under a soft magnetic layer in a perpendicular recording medium (*Figure 5,*

element 25 and col. 10, lines 4 – 12) resulting in exchange coupling with the soft magnetic layer adjacent to the hard bias magnetic layer inorder to suppress the occurrence of domain walls and spike Barkhausen noise (*col. 10, lines 13 – 24*), thereby meeting applicants' claimed limitations.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of Hikosaka et al. to include a hard magnetic layer meeting applicants' claimed limitations as taught by Akiyama et al. inorder to suppress the occurrence of domain walls and spike Barkhausen noise.

9. Claims 15 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hikosaka et al. as applied above, and further in view of Tang et al. (U.S. Patent No. 5,750,270).

Hikosaka et al. is relied upon as described above.

Hikosaka et al. fail to disclose oxidizing the surface of the soft magnetic underlayer.

However, Tang et al. teach that soft magnetic layers for perpendicular media can be annealed under oxygen, thereby necessarily oxidizing the surface of the soft magnetic underlayer, inorder to reduce the media noise (*col. 17, line 45 bridging col. 18, line 20*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hikosaka et al. to

oxidize the surface of the soft magnetic layer as taught by Tang et al. inorder to reduce the media noise.

10. Claims 2, 5 – 7, 13, 15, 17, 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shukh et al. as applied above, and further in view of Tang et al. ('270).

Shukh et al. is relied upon as described above.

Regarding claims 2, 13, 17 and 21, Shukh et al. fail to disclose a soft magnetic material meeting applicants' claimed limitations.

However, Tang et al. teach that the soft magnetic materials used by Shukh et al. (*Paragraphs 0026 and 0034*) are known equivalent soft magnetic materials to the claimed soft magnetic compositions (*col. 9, lines 9 – 21*).

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. In the instant case, NiFe and soft magnetic materials meeting applicants' claimed limitations are equivalents in the field of soft magnetic materials capable of use in perpendicular media. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Regarding claims 5 - 7, Shukh et al. disclose embodiments meeting applicants' claimed limitations (*Paragraphs 0007, 0026 and 0034; wherein $Ni_{45}Fe_{55}$ is known to possess a saturation magnetization ($M_s = B_s/4\pi$) value of ~1.6 T and Shukh et al. explicitly teaches using materials with a $B_s > 1$ T in Paragraph 0007; see pertinent prior art cited below – Inturi et al.*). The examiner

further notes that the exact thickness of the soft magnetic layers (and hence, the B_st values) are cause effective variables in terms of the magnetization force and direction (*Paragraph 0029*). It would, therefore, have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as the soft magnetic layer thickness, and hence also B_st value, through routine experimentation.

Regarding claims 15 and 19, Tang et al. teach that soft magnetic layers for perpendicular media can be annealed under oxygen, thereby necessarily oxidizing the surface of the soft magnetic underlayer, inorder to reduce the media noise (*col. 17, line 45 bridging col. 18, line 20*). It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Shukh et al. to oxidize the surface of the soft magnetic layer as taught by Tang et al. inorder to reduce the media noise.

11. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shukh et al. as applied above, and further in view of Akiyama et al. ('342).

Shukh et al. is relied upon as described above.

Shukh et al. fail to disclose a hard magnetic layer formed between the nonmagnetic substrate and the soft magnetic underlayer, wherein the magnetization of the hard magnetic layer is directed along the radius of the substrate and towards the periphery or the center of the substrate, and bonded with the magnetization of the soft magnetic layer which is the lowest layer of the soft magnetic underlayer.

However, Akiyama et al. teach that one can add a hard bias magnetic layer under a soft magnetic layer in a perpendicular recording medium (*Figure 5, element 25 and col. 10, lines 4 – 12*) resulting in exchange coupling with the soft magnetic layer adjacent to the hard bias magnetic layer inorder to suppress the occurrence of domain walls and spike Barkhausen noise (*col. 10, lines 13 – 24*), thereby meeting applicants' claimed limitations.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of Shukh et al. to include a hard magnetic layer meeting applicants' claimed limitations as taught by Akiyama et al. inorder to suppress the occurrence of domain walls and spike Barkhausen noise.

Response to Arguments

12. The rejection of claims 1 - 21 under 35 U.S.C § 102(b) and/or 103(a) – Hikosaka et al., alone or in combination with various references

Applicant(s) argue(s) that "the soft magnetic layer produces a magnetic field" and that Hikosaka et al. fails to teach or suggest that the direction of magnetization of the soft magnetic layer is along the radius of the substrate. The examiner respectfully disagrees.

The examiner notes that the specification is not the measure of the invention. Therefore, limitations contained therein can not be read into the claims for the purpose of avoiding prior art. *In re Sporck*, 55 CCPA 743, 386 F.2d 924, 155 USPQ 687 (1968). The claims do not exclude the magnetic field in the

soft magnetic layer being generated from external sources. Furthermore, the Examiner notes that the rejection of record states that the limitation in the direction of the magnetization was deemed to inherently be present in the Hikosaka et al. invention since Hikosaka et al. explicitly teaches that the antiferromagnetic layers generate bias magnetic fields *in the radial direction*. Presently there is no *evidence* of record refuting the above position of inherency. Applicant is reminded that attorney arguments are not evidence.

Regarding the Fullerton et al. reference, the Examiner notes that Fullerton et al. was merely supplied as evidentiary art to illustrate that antiferromagnetically coupled layers inherently have magnetization directions which are antiparallel to each other.

13. The rejection of claims 1 - 21 under 35 U.S.C § 102(e) and/or 103(a) – Shukh et al., alone or in combination with various references

Applicant(s) argue(s) that Shukh et al. does not disclose the magnetization directions to be in the radial direction and that the rejection under Shukh et al. should be withdrawn. The examiner respectfully disagrees.

The Examiner has reworded the prior rejection to better clarify that the Examiner has deemed that Figure 3 illustrates the magnetization directions in the radial direction given the similarities between the Shukh et al. invention and applicant's disclosed invention. Presently there is no evidence of record that the Shukh et al. invention would not necessarily possess the magnetization directions oriented in the radial direction given that the soft magnetic underlayer

is a multilayered underlayer wherein the magnetization directions of adjacent layers are antiparallel.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272 -1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (571) 272 - 1516. The fax phone number for the organization where this application or proceeding is assigned is (703) 872 - 9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272 - 2693.

KMB
January 2, 2004